USDA Natural Resources Conservation Service

Ecological site R055CY016SD
Very Shallow

Last updated: 1/31/2024
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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

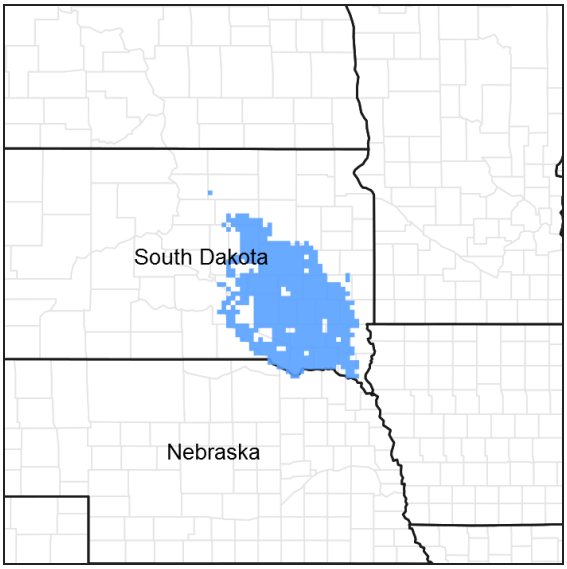


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 055C–Southern Black Glaciated Plains

The Southern Black Glaciated Plains (55C) is located within the Northern Great Plains Region. It is entirely within South Dakota encompassing about 10,835 square miles (Figure 1). The elevation ranges from 1,310 to 1,970 square feet. The MLRA is on nearly level to undulating glacial till plains interrupted by steeper slopes adjacent to streams and moraines. The James River is an under-fit stream. Its valley was carved by floodwaters draining glacial Lake Dakota and is filled with glacial outwash and alluvial deposits. (USDA-NRCS, 2006).

The dominant soil order in this MLRA is Mollisols. The soils in the area dominantly have a mesic soil temperature regime, an ustic soil moisture regime, and mixed or smectitic mineralogy. They generally are very deep, well drained to very poorly drained, and clayey or loamy. This area supports natural prairie vegetation characterized by western wheatgrass (Pascopyrum smithii), green needlegrass (Nassella viridula), needle and thread (Hesperostipa comata), and porcupinegrass (Hesperostipa spartea) with Prairie cordgrass (Spartina pectinata), and reed canarygrass (Phalaris arundinacea) as the dominant vegetation on the poorly drained soils. (USDA-NRCS, 2006).

Classification relationships

Major Land Resource Area (MLRA): Southern Black Glaciated Plains (55C) (USDA-NRCS, 2006)

USFS Subregions: North Central Glaciated Plains Section (251B); Yankton Hills and Valleys Subsection (251Bf); Western Glaciated Plains Section (332B); James River Lowland Subsection (332Bb); North Central Great Plains Section (332D); Southern Missouri Coteau Slope Subsection (332Dd); Southern Missouri Coteau Subsection (332De) - (Cleland et al., 2007).

US EPA Level IV Ecoregion: Southern Missouri Coteau (42e); Southern Missouri Coteau Slope (42f); James River Lowland (46n) - (USEPA, 2013)

Ecological site concept

The Very Shallow ecological site occurs on the shoulder slopes in the upland areas. Soils are well to excessively drained and have root restricting layer, such as sand and gravel or bedrock within 10 inches of the soil surface. Along with the root restricting layer, precipitation tends to runoff, leaving less soil moisture for plant growth, production is lower, and species composition will tend towards more tolerance to drought. In some areas the surface layer may consist of stony to extremely stony. Slopes can range from 0 to 40 percent. Vegetation in the Reference State is co-dominated by cool and warm-season grasses including needle and thread, little bluestem and western wheatgrass. Common forbs include dotted gayfeather, hairy goldaster, purpleconeflower, and prairie clover. Non-native grasses such as Kentucky bluegrass and annual bromes may invade due to shifts in disturbance regime.

Associated sites

R055CY010SD	**Loamy** These sites occur on upland areas. The soils are well drained and have sand and gravel at a depth of greater than 20 inches below the soil surface. The central concept soil series is Enet, but other series are included.
R055CY014SD	**Shallow To Gravel** These sites occur on upland areas. The soils are excessively drained and have sand and gravel within 10 to 20 inches of the soil surface. The central concept soil series is Delmont, but other series are included.

Similar sites

R055CY014SD	**Shallow To Gravel** The Shallow To Gravel site occurs in a backslope landscape position and does not have a root restricting layer, such as sand and gravel within 10 inches of the soil surface. The Shallow to Gravel site will have more big bluestem and higher production than a Very Shallow site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Hesperostipa comata* (2) *Nassella viridula*

Physiographic features

This site occurs on gently to steeply sloping uplands.

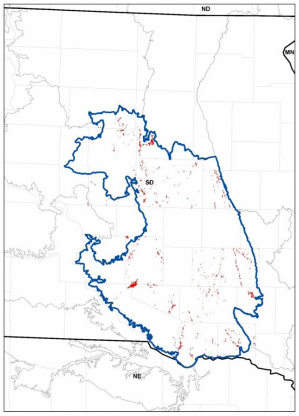


Figure 2. Distribution Map for the Very Shallow Site in MLRA 55C.

Table 2. Representative physiographic features

Landforms	(1) Moraine (2) Outwash terrace (3) Outwash plain
Flooding frequency	None
Ponding frequency	None
Elevation	396–610 m
Slope	4–35%
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 55C is considered to have a continental climate: Cold winters and hot summers, low humidity, light rainfall, and much sunshine. Extremes in temperature may also abound. The climate is the result of this MLRA’s location near the geographic center of North America. There are few natural barriers on the Northern Great Plains, and air masses move freely across the plains and account for rapid changes in temperature.

Annual precipitation typically ranges from 19 to 25 inches per year. The average annual temperature is about 47°F. January is the coldest month with average temperatures ranging from about 15°F (Howard, South Dakota [SD]), to about 20°F (Wagner, SD). July is the warmest month with temperatures averaging from about 73°F (Howard, SD), to about 77°F (Wagner, SD). The range of normal average monthly temperatures between the coldest and warmest months is about 58°F. This large annual range attests to the continental nature of this area's climate. Hourly winds are estimated to average about 12 miles per hour (mph) annually, ranging from about 13 mph during the spring to about 11 mph during the summer. Daytime winds are generally stronger than nighttime, and occasional strong storms may bring brief periods of high winds with gusts to more than 50 mph.

Growth of cool-season plants begins in early to mid-March, slowing or ceasing in late June. Warm-season plants begin growth about mid-May and continue to early or mid-September. Green-up of cool-season plants may occur in September and October when adequate soil moisture is present.

Table 3. Representative climatic features

Frost-free period (characteristic range)	122-130 days
Freeze-free period (characteristic range)	137-150 days
Precipitation total (characteristic range)	559-660 mm
Frost-free period (actual range)	114-131 days

Freeze-free period (actual range)	133-155 days
Precipitation total (actual range)	533-686 mm
Frost-free period (average)	125 days
Freeze-free period (average)	144 days
Precipitation total (average)	610 mm

Climate stations used

- (1) FAULKTON 1 NW [USC00392927], Faulkton, SD
- (2) REDFIELD [USC00397052], Redfield, SD
- (3) MILLER [USC00395561], Miller, SD
- (4) HURON RGNL AP [USW00014936], Huron, SD
- (5) DE SMET [USC00392302], De Smet, SD
- (6) HOWARD [USC00394037], Howard, SD
- (7) FORESTBURG 4 NNE [USC00393029], Artesian, SD
- (8) CHAMBERLAIN MUNI AP [USW00094943], Chamberlain, SD
- (9) CHAMBERLAIN 5 S [USC00391621], Chamberlain, SD
- (10) ACADEMY 2NE [USC00390043], Platte, SD
- (11) ARMOUR [USC00390296], Armour, SD
- (12) WAGNER [USC00398767], Wagner, SD
- (13) TYNDALL [USC00398472], Tyndall, SD
- (14) MENNO [USC00395481], Menno, SD
- (15) BRIDGEWATER [USC00391032], Bridgewater, SD
- (16) SALEM 5NE [USC00395360], Salem, SD
- (17) ALEXANDRIA [USC00390128], Alexandria, SD
- (18) MITCHELL MUNI AP [USW00094950], Mitchell, SD
- (19) MITCHELL [USC00395669], Mitchell, SD
- (20) MITCHELL 2 N [USC00395671], Mitchell, SD

Influencing water features

No riparian areas or wetland features are directly associated with this site.

Soil features

The common features of soils in this site are the gravelly loam to extremely gravelly sand textured subsoil and slopes of 4 to 35 percent. The soils in this site are excessively well-drained and formed in till outwash materials. The loam or gravelly loam surface layer is 5 to 10 inches thick. The soils have a moderate to rapid infiltration rate. This site should show no evidence of rills, wind scoured areas, or pedestalled plants. If present, water flow paths are broken, irregular in appearance, or discontinuous. The soil surface is very unstable but intact. Subsurface soil layers are restrictive to root penetration.

Soil series is Talmo.

These soils are mainly susceptible to water erosion. The hazard of water erosion increases on slopes greater than about 15 percent. Low available water capacity caused by the shallow rooting depth strongly influences the soil-water-plant relationship. Loss of the soil surface layer can result in a shift in species composition and production.

Access Web Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm) for specific local soils information.

Table 4. Representative soil features

Surface texture	(1) Gravelly loam
Family particle size	(1) Sandy

Drainage class	Excessively drained
Permeability class	Moderate to rapid
Soil depth	13–25 cm
Surface fragment cover <=3"	5–13%
Surface fragment cover >3"	2–30%
Available water capacity (0-101.6cm)	5.08–7.62 cm
Calcium carbonate equivalent (0-101.6cm)	0–25%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	30–60%
Subsurface fragment volume >3" (Depth not specified)	3–10%

Ecological dynamics

The site which is located in the Southern Black Glaciated Plains Region developed under Northern Great Plains climatic conditions and included natural influence of large herding herbivores and occasional fire. Changes will occur in the plant communities due to weather fluctuations and management actions. Under adverse impacts, a relatively rapid decline in vegetative vigor and composition can occur. Under favorable conditions, the site has the potential to resemble the Reference State. Interpretations for this site are based primarily on the 1.1 Needle and Thread-Blue Grama-Western Wheatgrass Plant Community Phase. This community phase and the Reference State have been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under long-term rotational grazing regimes. Trends in plant community dynamics ranging from heavily to lightly grazed areas, seasonal use pastures, and historical accounts also have been considered.

This ecological site (ES) has been grazed by domestic livestock since they were introduced into the area. This ecological site is naturally resilient, and quite resistant to change. Also, due to the relatively steep slopes and naturally low fertility of the soils, this site generally avoids more intensive disturbances such as farming. However, continuous season-long grazing (during the typical growing season of May through October) or repeated seasonal grazing (e.g., every spring, every summer without adequate recovery periods following each grazing occurrence) can cause this site to depart from the Needle and Thread-Blue Grama-Western Wheatgrass Plant Community Phase. Sedges and gramas can increase and eventually develop into a sod while many of the tall and mid-statured grasses will decrease [e.g., little bluestem (*Schizachyrium scoparium*), green needlegrass, needle and thread, porcupinegrass, and western wheatgrass]. Even with these disturbances, many of the tall- and mid-statured grasses will remain in the community at reduced levels, allowing recovery to occur once the disturbances are removed.

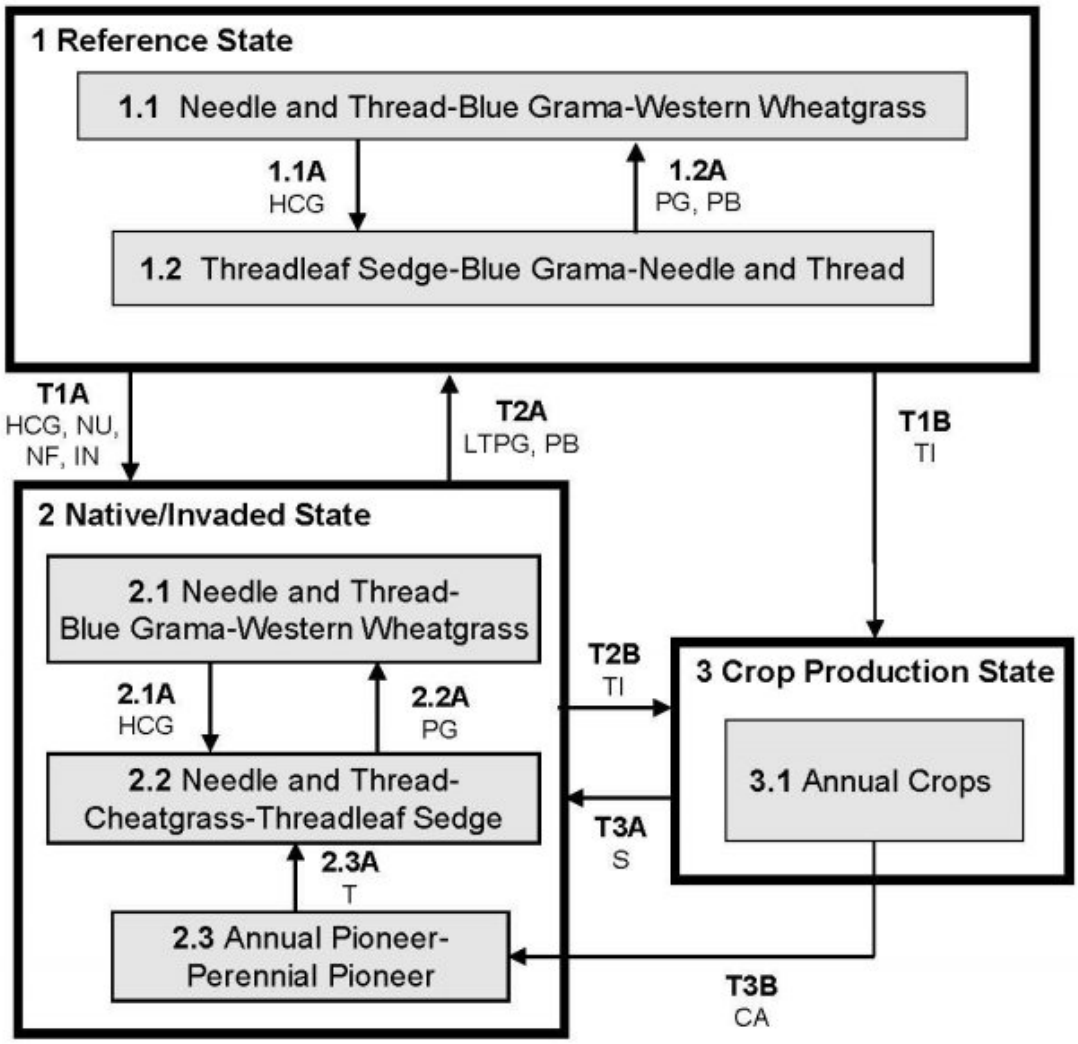
Following the state-and-transition diagram are narratives for each of the described states and community phases. These may not represent every possibility, but they are the most prevalent and repeatable states and community phases. The associated plant composition tables have been developed from the best available knowledge at the time of this revision. As more data are collected, some of these community phases and states may be revised or removed, and new ones may be added. The main purpose for including the descriptions here is to capture the current knowledge and experience at the time of this revision.

The following is a diagram that illustrates the common plant community phases that can occur on the site and the transition and community pathways between them. The ecological processes will be discussed in more detail in the

plant community descriptions following the diagram.

State and transition model

Very Shallow – R055CY016SD



LEGEND
Very Shallow – R055CY016SD

CA – Cropped and abandoned
HCG – Heavy, continuous grazing
IN – Invasion
LTPG – Long-term prescribed grazing
NU – Non-use
NF – No fire
PB – Prescribed burning
PG – Prescribed grazing
S – Seeding
T – Time w/wo disturbances
TI – Tillage

Figure 9. State-and-Transition Model and Legend for the Very Shallow Site in MLRA 55C.

Code	Process
T1A	Heavy, continuous grazing, inundation, non-use, no fire
T1B	Tillage
T2A	Long term prescribed grazing, prescribed burning
T2B	Tillage
T3A	Seeding
T3B	Abandonment of cropping
1.1A	Heavy, continuous grazing
1.2A	Prescribed grazing with recovery periods, prescribed burning
2.1A	Heavy, continuous grazing
2.2A	Prescribed grazing with recovery periods
2.3A	Time w/wo disturbance

Figure 10. Matrix for the Very Shallow Site in MLRA 55C.

State 1
Reference State

The Reference State represents the natural range of variability that dominates the dynamics of this ES. This state represents the natural range of variability that dominates the dynamics of this ecological site (ES). This state is dominated by cool-season grasses with warm-season grasses being subdominant. Prior to European settlement in North America, the primary disturbance mechanisms for this site in the reference condition included grazing by large herding ungulates and fluctuations in levels of precipitation. Grazing coupled with weather events dictated the dynamics that occurred within the natural range of variability. Today, this state can be found on areas that are properly managed with grazing and/or prescribed burning and sometimes on areas receiving occasional short periods of rest. The dominant tall and mid-grass species can decline and a corresponding increase in short-statured species will occur.

Community 1.1
Needle and Thread-Blue Grama-Western Wheatgrass

Interpretations are based primarily on the 1.1 Needle and Thread-Blue Grama-Western Wheatgrass Plant Community Phase (this is also considered to be the Reference Community). This plant community evolved with grazing by large herbivores, frequent surface fires, and periodic flooding events and is suited for grazing by domestic livestock. This plant community can be found on areas that are properly managed with prescribed grazing that allows for proper utilization, changes in season of use, and adequate recovery periods following each grazing event. The potential vegetation is about 75 percent grasses or grass-like plants, 15 percent forbs, and 10 percent shrubs. Cool-season grass and grass-like species dominate this plant community, with warm-season grasses being subdominant. The major grass or grass-like species include needle and thread, blue grama, threadleaf sedge, green needlegrass, porcupinegrass, hairy grama (*Bouteloua hirsuta*), sideoats grama (*Bouteloua curtipendula*), and needleleaf sedge (*Carex duriuscula*). Other grasses occurring on the site include threeawn (Aristida), plains muhly (*Muhlenbergia cuspidata*), little bluestem (*Schizachyrium scoparium*), and prairie Junegrass (*Koeleria macrantha*). The significant forbs include dotted gayfeather (*Liatris punctata*), hairy goldaster (*Heterotheca villosa*), purple coneflower (Echinacea), and prairie clover (Dalea). Significant shrubs are fringed sagewort (*Artemisia frigida*), leadplant (*Amorpha canescens*), rose (Rosacaeae), skunkbush sumac (*Rhus trilobata*), and snowberry (Symphoricarpos). This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term. This plant community is stable and protected from excessive erosion.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1166	1573	1928
Forb	90	191	325
Shrub/Vine	90	142	213
Total	**1346**	**1906**	**2466**

Figure 12. Plant community growth curve (percent production by month). SD5502, Southern Black Glaciated Plains, cool-season dominant, warm-season . Cool-season dominant, warm-season subdominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

Community 1.2
Threadleaf Sedge-Blue Grama-Needle and Thread

This plant community can develop from the adverse effects of heavy, continuous grazing in conjunction with extended periods of below average precipitation. Short-grass and grass-like species increase to dominate the site and annual production decreases. Lack of litter and short plant heights result in higher soil temperatures, poor water infiltration rates, and higher evaporation, which gives blue grama and sedges a competitive advantage over cool- and warm-season mid-grasses. Threadleaf sedge, blue grama, and needle and thread are the dominant grass and grass-like species. Other grasses may include western wheatgrass, prairie Junegrass, and threeawn. Significant

forbs include green sagewort (*Artemisia campestris*), cutleaf ironplant (*Machaeranthera pinnatifida*), scurfpeas (Psoralidium), white prairie aster (*Symphyotrichum falcatum*), and woolly Indianwheat (*Plantago patagonica*). Common shrubs include fringed sagewort, cactus (Cactaceae), and snowberry. Non-native species such as Kentucky bluegrass (*Poa pratensis*), cheatgrass (*Bromus tectorum*), and Japanese bromegrass (Bromus japonicus) may begin to invade this phase. This plant community is relatively stable. The competitive advantage of blue grama and threadleaf sedge prevents other species from establishing. This plant community is less productive than the 1.1 Needle and Thread-Blue Grama-Western Wheatgrass Plant Community Phase. Runoff has increased and infiltration has decreased. Soil erosion does not increase substantially.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	673	1018	1451
Forb	56	123	207
Shrub/Vine	56	92	135
Total	**785**	**1233**	**1793**

Figure 14. Plant community growth curve (percent production by month). SD5502, Southern Black Glaciated Plains, cool-season dominant, warm-season . Cool-season dominant, warm-season subdominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

Pathway 1.1A
Community 1.1 to 1.2

Heavy, continuous grazing (which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites) will shift this community to the 1.2 Threadleaf Sedge-Blue Grama-Needle and Thread Plant Community Phase.

Pathway 1.2A
Community 1.2 to 1.1

Non-use, no surface fire for 10 or more years (causing litter levels to become high enough to reduce native grass vigor, diversity, and density), heavy, continuous grazing, or invasion of non-native plant species will likely lead this state over a threshold resulting in the Native/Invaded State (State 2).

State 2
Native/Invaded State

The Native/Invaded State represents the more common range of variability that exists with higher levels of grazing management, but in the absence of periodic fire due to fire suppression. This state is dominated by cool-season grasses. It can be found on areas that are properly managed with grazing and/or prescribed burning and sometimes on areas receiving occasional short periods of rest. Taller cool-season species can decline and a corresponding increase in short-statured grass will occur. Non-native species such as cheatgrass or Japanese bromegrass can become dominant at times and influence the biotic and hydrologic ecological processes of the State.

Community 2.1
Needle and Thread-Blue Grama-Western Wheatgrass

This plant community is the result of encroachment of non-native species, often as a result of fluctuations in precipitation cycles (typically extended periods of below average precipitation followed by a mild winter or a cool, wet spring). The potential vegetation is about 75 percent grasses or grass-like plants, 15 percent forbs, and 10 percent shrubs. Cool-season grass and grass-like species dominate this plant community, with warm-season

grasses being subdominant. The major grass or grass-like species include needlegrasses (needle and thread, green needlegrass, and porcupinegrass), blue and hairy grama, western wheatgrass, threadleaf sedge, and needleleaf sedge. Other grasses occurring on the site include threeawn, plains muhly, little bluestem, prairie Junegrass, and non-native species such as Kentucky bluegrass, cheatgrass, and Japanese bromegrass. The significant forbs include dotted gayfeather, purple coneflower, prairie clover, and hairy goldaster. Significant shrubs are fringed sagewort, leadplant, rose, and snowberry. This plant community is very similar to the 1.1 Needle and Thread-Blue Grama-Western Wheatgrass Plant Community Phase. The main difference is that this plant community will have a minor amount on non-native grasses, up to about 10 to 15 percent by weight. This plant community is moderately resistant to change. The herbaceous species present are well adapted to grazing; however, species composition can be altered through long-term overgrazing. If the herbaceous component is intact, it tends to be resilient if the disturbance is not long-term. This plant community is stable and protected from excessive erosion.

Figure 15. Plant community growth curve (percent production by month). SD5502, Southern Black Glaciated Plains, cool-season dominant, warm-season . Cool-season dominant, warm-season subdominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	10	23	34	15	6	5	4	0	0

Community 2.2
Needle and Thread-Cheatgrass-Threadleaf Sedge

This plant community can develop from the adverse effects of heavy, continuous grazing in conjunction with extended periods of below average precipitation. This plant community phase is further impacted by the invasion of non-native species such as cheatgrass, Japanese bromegrass, and Kentucky bluegrass. Needlegrasses will be evident on the aspect of this phase but will be reduced in vigor and production. Annual bromegrass and sedge will make up a bulk of the composition on this plant community phase. The dominant grass and grass-like species will include needlegrass (needle and thread, green needlegrass, and porcupinegrass), cheatgrass, Japanese bromegrass, threadleaf sedge, and needleleaf sedge. Other grasses present include western wheatgrass, blue grama, threeawn, Kentucky bluegrass, hairy grama, and prairie Junegrass. Significant forbs include green sagewort, cutleaf ironplant, scurfpeas, white prairie aster, and woolly Indianwheat. Common shrubs include cactus, snowberry, and fringed sagewort. Lack of litter and short plant heights result in higher soil temperatures, poor water infiltration rates, and higher evaporation, which gives sedges and annual bromegrass a competitive advantage over cool-and warm-season mid-grasses. This plant community is relatively stable. The competitive advantage of blue grama and threadleaf sedge prevents other species from establishing. This plant community is less productive than the 1.1 Needle and Thread-Blue Grama-Western Wheatgrass Plant Community Phase. Runoff has increased and infiltration has decreased. Soil erosion does not increase substantially.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	482	740	992
Forb	39	90	146
Shrub/Vine	39	67	95
Total	**560**	**897**	**1233**

Figure 17. Plant community growth curve (percent production by month). SD5501, Southern Black Glaciated Plains, cool-season dominant.. Cool-season dominant..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	4	12	25	36	10	5	4	4	0	0

Community 2.3
Annual Pioneer-Perennial Pioneer

This plant community developed under continuous, heavy grazing or other excessive disturbances (e.g., heavy use

areas, defoliation by rodents, etc.). The potential plant community is made up of approximately 40 to 80 percent grasses and grass-like species, 20 to 60 percent forbs, and 0 to 5 percent shrubs. The species present in this phase are highly variable, but often include non-native invasive and early seral species. Plant diversity is low (plant richness may be high but areas are often dominated by a few species). The ecological processes are difficult to restore because of the loss of plant diversity and overall soil disturbance. Soil erosion is potentially very high because of the bare ground and shallow rooted herbaceous plant community. Water runoff will increase and infiltration will decrease due to animal related soil compaction and loss of root mass due to low plant diversity and vigor. This plant community will require significant economic inputs and time to move towards another plant community. This movement is highly variable in its succession. This is due to the loss of diversity (including the loss of the seed bank), within the existing plant community, and the plant communities on adjacent sites. This community can be renovated to improve the production capability; however, if management changes are not made the vegetation could revert back to invasive or early seral species.

Pathway 2.1A
Community 2.1 to 2.2

Heavy, continuous grazing (which includes herbivory at moderate to heavy levels at the same time of year each year without adequate recovery periods, or during periods of below normal precipitation when grazing frequency and intensity increases on these sites due to limited forage availability on adjacent upland sites) and no surface fire for 10 years or more (causing litter levels to become high enough to reduce native grass vigor, diversity, and density), will shift this community to the 2.2 Needle and Thread-Cheatgrass-Threadleaf Sedge Plant Community Phase.

Pathway 2.2A
Community 2.2 to 2.1

Prescribed grazing (alternating season of use and providing adequate recovery periods) or periodic light to moderate grazing (possibly including periodic rest) will convert this plant community to the 2.1 Needle and Thread-Blue Grama-Western Wheatgrass Plant Community Phase. This pathway could also occur with a return to more normal precipitation levels and frequencies.

Conservation practices

Prescribed Grazing

Pathway 2.3A
Community 2.3 to 2.2

This community pathway occurs with the passage of time as successional processes take place and perennial plants gradually begin to establish on the site again. This pathway will lead to the 2.2 Needle and Thread-Cheatgrass-Threadleaf Sedge Plant Community Phase.

State 3
Crop Production State

The Crop Production State is characterized by the production of annual crops using a variety of tillage and cropping systems along with management practices.

Community 3.1
Annual Crops

This plant community developed with the use of a variety of tillage and cropping systems for the production of annual crops including corn, soybeans, wheat, and a variety of other crops.

Transition T1A
State 1 to 2

Non-use, no surface fire for 10 or more years (causing litter levels to become high enough to reduce native grass vigor, diversity, and density), heavy continuous grazing, or invasion of non-native plant species will likely lead this state over a threshold resulting in the Native/Invaded State (State 2).

Transition T1B
State 1 to 3

Tillage will cause a shift over a threshold leading to the 3.1 Annual Crops Plant Community Phase within the Crop Production State (State 3).

Restoration pathway T2A
State 2 to 1

Long-term prescribed grazing (moderate stocking levels coupled with adequate recovery periods, or other grazing systems such as high-density, low-frequency intended to treat specific species dominance, or periodic light to moderate stocking levels possibly including periodic rest), prescribed burning every 3 to 5 years, and a return to normal disturbance regime levels may lead this plant community phase over a threshold to the Reference State (State 1).

Conservation practices

Prescribed Grazing

Transition T2B
State 2 to 3

Tillage will cause a shift over a threshold leading to the 3.1 Annual Crops Plant Community Phase within the Crop Production State (State 3).

Restoration pathway T3A, T3B
State 3 to 2

Seeding may lead this Crop Production State (State 3) over a threshold to the Native/Invaded State (State 2). Cropping followed by abandonment may lead this plant community phase over a threshold to the Native/Invaded State (State 3) and more specifically to the 2.3 Annual Pioneer-Perennial Pioneer Plant Community Phase.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Needlegrass**			381–667	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	191–476	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	95–381	–
	green needlegrass	NAVI4	*Nassella viridula*	95–381	–
2	**Short Warm-Season Grasses**			191–381	
	blue grama	BOGR2	*Bouteloua gracilis*	95–286	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	38–191	–
	threeawn	ARIST	*Aristida*	19–57	–
3	**Wheatgrass**			95–286	
	western wheatgrass	PASM	*Pascopyrum smithii*	95–286	–
4	**Mid Warm-Season Grasses**			57–191	

	plains muhly	MUCU3	*Muhlenbergia cuspidata*	38–133	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–95	–
5	**Other Native Grasses**			19–95	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–76	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	19–57	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–38	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–38	–
6	**Grass-likes**			95–191	
	threadleaf sedge	CAFI	*Carex filifolia*	38–152	–
	needleleaf sedge	CADU6	*Carex duriuscula*	19–95	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–76	–
Forb					
7	**Forbs**			95–286	
	Forb, native	2FN	*Forb, native*	19–57	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	19–57	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	19–57	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	19–57	–
	dotted blazing star	LIPU	*Liatris punctata*	19–38	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	19–38	–
	false boneset	BREU	*Brickellia eupatorioides*	0–38	–
	field sagewort	ARCA12	*Artemisia campestris*	19–38	–
	purple prairie clover	DAPU5	*Dalea purpurea*	19–38	–
	white heath aster	SYER	*Symphyotrichum ericoides*	19–38	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	19–38	–
	American vetch	VIAM	*Vicia americana*	19–38	–
	white prairie clover	DACA7	*Dalea candida*	0–19	–
	milkvetch	ASTRA	*Astragalus*	0–19	–
	pussytoes	ANTEN	*Antennaria*	0–19	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–19	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–19	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–19	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–19	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–19	–
	buckwheat	ERIOG	*Eriogonum*	0–19	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	0–19	–
Shrub/Vine					
8	**Shrubs**			95–191	
	leadplant	AMCA6	*Amorpha canescens*	19–57	–
	prairie sagewort	ARFR4	*Artemisia frigida*	19–57	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–38	–
	rose	ROSA5	*Rosa*	19–38	–
	snowberry	SYMPH	*Symphoricarpos*	19–38	–
	soapweed yucca	YUGL	*Yucca glauca*	0–38	–

	soapweed yucca	YUGL	*Yucca glauca*	0–38	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–19	–
	skunkbush sumac	RHTR	*Rhus trilobata*	0–19	–

Table 9. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Needlegrass**			62–185	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–185	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–185	–
	green needlegrass	NAVI4	*Nassella viridula*	0–185	–
2	**Short Warm-Season Grasses**			185–370	
	blue grama	BOGR2	*Bouteloua gracilis*	123–308	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	37–185	–
	threeawn	ARIST	*Aristida*	25–99	–
3	**Wheatgrass**			12–123	
	western wheatgrass	PASM	*Pascopyrum smithii*	12–123	–
4	**Mid Warm-Season Grasses**			0–62	
	plains muhly	MUCU3	*Muhlenbergia cuspidata*	0–62	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0–25	–
5	**Other Native Grasses**			12–49	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–37	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	12–25	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0–12	–
	fall rosette grass	DIWI5	*Dichanthelium wilcoxianum*	0–12	–
6	**Grass-likes**			185–370	
	threadleaf sedge	CAFI	*Carex filifolia*	123–247	–
	needleleaf sedge	CADU6	*Carex duriuscula*	62–185	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–123	–
7	**Non-Native Grasses**			0–123	
	field brome	BRAR5	*Bromus arvensis*	0–123	–
	cheatgrass	BRTE	*Bromus tectorum*	0–123	–
	bluegrass	POA	*Poa*	0–37	–
Forb					
8	**Forbs**			62–185	
	white sagebrush	ARLU	*Artemisia ludoviciana*	12–62	–
	Forb, introduced	2FI	*Forb, introduced*	0–49	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	12–49	–
	field sagewort	ARCA12	*Artemisia campestris*	12–49	–
	Forb, native	2FN	*Forb, native*	12–37	–
	white heath aster	SYER	*Symphyotrichum ericoides*	12–37	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–25	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	12–25	–

	silvercal indian breadroot	PLAR6	*Pediomelum argophyllum*	12–25	
	woolly plantain	PLPA2	*Plantago patagonica*	0–12	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	0–12	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	0–12	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–12	–
	dotted blazing star	LIPU	*Liatris punctata*	0–12	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–12	–
	buckwheat	ERIOG	*Eriogonum*	0–12	–
	pussytoes	ANTEN	*Antennaria*	0–12	–
	purple prairie clover	DAPU5	*Dalea purpurea*	0–12	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	0–12	–
	American vetch	VIAM	*Vicia americana*	0–12	–
Shrub/Vine					
9	**Shrubs**			62–123	
	prairie sagewort	ARFR4	*Artemisia frigida*	12–62	–
	soapweed yucca	YUGL	*Yucca glauca*	0–37	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–25	–
	snowberry	SYMPH	*Symphoricarpos*	0–25	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–25	–
	leadplant	AMCA6	*Amorpha canescens*	0–12	–
	rose	ROSA5	*Rosa*	0–12	–

Table 10. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Needlegrass**			45–179	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–179	–
	porcupinegrass	HESP11	*Hesperostipa spartea*	0–179	–
	green needlegrass	NAVI4	*Nassella viridula*	0–179	–
2	**Short Warm-Season Grasses**			45–135	
	threeawn	ARIST	*Aristida*	18–108	–
	blue grama	BOGR2	*Bouteloua gracilis*	18–90	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0–63	–
3	**Wheatgrass**			0–27	
	western wheatgrass	PASM	*Pascopyrum smithii*	0–27	–
4	**Other Native Grasses**			0–27	
	Graminoid (grass or grass-like)	2GRAM	*Graminoid (grass or grass-like)*	0–27	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–18	–
5	**Grass-likes**			135–269	
	threadleaf sedge	CAFI	*Carex filifolia*	90–179	–
	needleleaf sedge	CADU6	*Carex duriuscula*	45–135	–
	sun sedge	CAINH2	*Carex inops ssp. heliophila*	0–90	–
6	**Non-Native Grasses**			90–269	

	field brome	BRAR5	*Bromus arvensis*	45–179	–
	cheatgrass	BRTE	*Bromus tectorum*	45–179	–
	bluegrass	POA	*Poa*	0–45	–
Forb					
7	**Forbs**			45–135	
	Forb, introduced	2FI	*Forb, introduced*	9–72	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	9–63	–
	field sagewort	ARCA12	*Artemisia campestris*	9–54	–
	white heath aster	SYER	*Symphyotrichum ericoides*	9–36	–
	Forb, native	2FN	*Forb, native*	0–18	–
	blacksamson echinacea	ECAN2	*Echinacea angustifolia*	9–18	–
	buckwheat	ERIOG	*Eriogonum*	0–9	–
	silverleaf Indian breadroot	PEAR6	*Pediomelum argophyllum*	0–9	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–9	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0–9	–
	pussytoes	ANTEN	*Antennaria*	0–9	–
Shrub/Vine					
8	**Shrubs**			45–90	
	prairie sagewort	ARFR4	*Artemisia frigida*	18–72	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–36	–
	soapweed yucca	YUGL	*Yucca glauca*	0–36	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–27	–
	snowberry	SYMPH	*Symphoricarpos*	0–9	–

Animal community

The following table lists annual, suggested initial stocking rates with average growing conditions. These are conservative estimates that should be used only as guidelines in the initial stages of conservation planning. Often, the current plant composition does not entirely match any particular plant community (as described in this ES description). Because of this, a resource inventory is necessary to document plant composition and production. More accurate carrying capacity estimates should eventually be calculated using the following stocking rate information along with animal preference data and actual stocking records, particularly when grazers other than cattle are involved. Following consultation of the land manager, more intensive grazing management may result in improved harvest efficiencies and increased carrying capacity. Stocking rates are calculated using Animal-Unit-Month (AUM), which is the amount of air-dry forage required to feed a cow, with or without calf, for one month.

Needlegrass/Grama/Western Wheatgrass (1.1 & 2.1)
Average Annual Production (lbs./acre, air-dry): 1,700
Stocking Rate* (AUM/acre): 0.47

Sedge/Grama/Needlegrass (1.2)
Average Annual Production (lbs./acre, air-dry): 1,100
Stocking Rate* (AUM/acre): 0.30

Needlegrass/Annual Bromegrass/Sedge (2.2)
Average Annual Production (lbs./acre, air-dry): 800
Stocking Rate* (AUM/acre): 0.22

*Based on 912 lbs./acre (air-dry weight) per Animal Unit Month (AUM) and on 25 percent harvest efficiency (refer to

United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), National Range and Pasture Handbook).

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangeland in this area may provide yearlong forage. During the dormant period, the forage for livestock will likely be lacking protein to meet livestock requirements and added protein will allow ruminants to better utilize the energy stored in grazed plant materials. A forage quality test (either directly or through fecal sampling) should be used to determine the level of supplementation needed.

Hydrological functions

Water is the principal factor limiting forage production on this site. This site is typically dominated by soils in hydrologic group A. Infiltration and runoff potential for this site varies from moderate to high depending on soil hydrologic group, slope, and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where short-grasses form a strong sod and dominate the site. Dominance by blue grama, buffalograss, bluegrass, or smooth bromegrass will result in reduced infiltration and increased runoff. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Section 4, NRCS National Engineering Handbook for runoff quantities and hydrologic curves).

Recreational uses

This site provides hunting, hiking, photography, bird watching, and other opportunities. The wide varieties of plants that bloom from spring until fall have an aesthetic value that appeals to visitors.

Wood products

No appreciable wood products are typically present on this site.

Other products

Seed harvest of native plant species can provide additional income on this site.

Other information

Ecological Site Correlation Issues and Questions:

• SD097 Miner County, SD did not use the (DtB) Delmont-Talmo loams, 2 to 6 percent slopes (national symbol g0dw) as used in the adjoining SD077 Kingsbury County, SD.
• SD097 Miner County, SD did not use the (TaD) Talmo-Betts loams, 6 to 15 percent slopes (national symbol g0zz) as used in the adjoining SD087 McCook County, SD.
• SD035 Davison County, SD did not use the (DnC) Delmont-Talmo complex, 6 to 15 percent slopes (national symbol cx7j) as used in the adjoining SD003 Aurora County, SD.
• SD035 Davison County, SD did not use the (TaC) Talmo gravelly loam, 2 to 15 percent slopes (national symbol cx8b) as used in the adjoining SD003 Aurora County, SD.
• Reference and alternative states within the state and transition model are may not be fully documented and may require additional field sampling for refinement.

Inventory data references

There is no NRCS clipping data and other inventory currently available for this site. Information presented here has been derived using field observations from range-trained personnel. Those involved in developing this site include: Stan Boltz, Range Management Specialist, NRCS; and Bruce Kunze, Soil Scientist, NRCS.

Data Source Sample Period State County
NONE

Other references

Cleland, D.T., J.A. Freeouf, J.E. Keys, G.J. Nowacki, C. Carpenter, and W.H. McNab. 2007. Ecological Subregions: Sections and Subsections of the Coterminous United States. USDA Forest Service, General Technical Report WO-76. Washington, DC.

Gilbert, M. C., Whited, P. M., Clairain Jr, E. J., & Smith, R. D. (2006). A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Prairie Potholes. Washington DC.

Samson, F. B., & Knopf, F. L. (1996). Prairie Conservation Preserving North America's Most Endagered Ecosystem. Washington D.C.: Island Press.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Official Soil Series Descriptions. Available online. Accessed March 2018.

United States Department of Agriculture – Natural Resource Conservation Service (USDA-NRCS). 2003. National Range and Pasture Handbook, Revision 1. Grazing Lands Technology Institute.

United States Department of Agriculture – Natural Resource Conservation Service (USDA-NRCS). 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

USDA, NRCS. National Soil Information System, Information Technology Center, (http://soils.usda.gov/technical/nasis/)

USDA, NRCS. 2019. The PLANTS Database (http://plants.usda.gov, 13 March 2019).

U.S. Environmental Protection Agency [EPA]. 2013. Level III and Level IV Ecoregions of the Continental United States. Corvallis, OR, U.S. EPA, National Health and Environmental Effects Research Laboratory, map scale 1:3,000,000. Available at http://www.epa.gov/eco-research/level-iii-and-iv-ecoregions- continental-united-states. (Accessed 13 March 2019).

High Plains Regional Climate Center, University of Nebraska. (http://www.hprcc.unl.edu/)

USDA, NRCS. National Water and Climate Center. (http://wcc.nrcs.usda.gov)

USDA, NRCS. National Range and Pasture Handbook, September 1997

USDA, NRCS. 2001. The PLANTS Database, Version 3.1 (http://plants.usda.gov). National Plant Data Center.

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Approval

Suzanne Mayne-Kinney, 1/31/2024

Acknowledgments

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This Provisional Ecological Site concept has passed both Quality Control and Quality Assurance processes. Officially approved for publication by David Kraft as of 11/12/2020.

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	David Schmidt, Tim Nordquist, Stan Boltz
Contact for lead author	david.schmidt@sd.usda.gov 605-352-1236
Date	12/07/2004
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills should not be present.

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2. **Presence of water flow patterns:** Typically not observable.

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3. **Number and height of erosional pedestals or terracettes:** None.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground 20-40 percent.

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5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None.

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7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class usually 4-6. Moderately high root content. Soil surface is resistant to erosion, in large part due to high rock/gravel content.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Use soil series description for depth and color of A-horizon.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Healthy, native grasses enhance infiltration and reduce runoff.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer should be evident.

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Mid and tall cool-season bunchgrasses >

    Sub-dominant: Short warm-season grasses > mid cool-season rhizomatous grass = forbs >

    Other: Mid warm-season grasses = short grass-likes = shrubs > short cool-season grasses.

    Additional: Due to differing root structure and distribution, Kentucky bluegrass and smooth bromegrass do not fit into reference plant community F/S groups.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very little to no evidence of decadence or mortality.

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1,200–2,200 lbs./acre air-dry weight, average 1,700 lbs./acre air-dry weight.

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Refer to State and Local Noxious Weed List.

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17. **Perennial plant reproductive capability:** All species are capable of reproducing.
